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Testing strategic pluralism: The roles of attractiveness and competitive abilities to understand conditionality in men's short-term reproductive strategies

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Abstract:	The decision to allocate time and energy to find multiple sexual partners or raise children is a fundamental reproductive trade-off. The strategic pluralism hypothesis argues that human reproductive strategies are optionally calibrated towards mating or raising children, according to the expression of features dependent on the individual's condition, such as a selective response to the reproductive trade-off. This study seeks to test predictions derived from this hypothesis in a sample of 243 young men (M ± SD = 22.21 ± 3.20) from Chile's 5th Region. Specifically, three predictions were considered that raise questions about the relationship between traits related to physical and psychological attractiveness (fluctuating facial asymmetry and self-perception of attractiveness) and competitive skills (baseline testosterone and self-perception of fighting ability) with short-term reproductive strategies. Our results indicate that psychological features related to the self-perception of physical attractiveness and competitive abilities are related to short-term reproductive strategies. It was also established that the effect of fluctuating facial asymmetry on short-term reproductive strategies is fully mediated by the self-perception of physical attractiveness. No evidence was found of any interaction between traits that denote physical attractiveness and those that denote competitive skills. These results support the existing evidence of the importance of facial fluctuating asymmetry as a highly-valued characteristic in terms of sexual selection. They also suggest that traits related to physical attractiveness, in comparison to competitive capabilities, play a relatively more important role in calibrating men's short-term reproductive strategies.
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Testing strategic pluralism: The roles of attractiveness and competitive abilities to understand conditionality in men's short-term reproductive strategies

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Contributions: Figueroa O., Polo P. and Muñoz-Reyes J.A. designed the study, interpreted the results and wrote the manuscript. Valenzuela, N., Pavez P., Ramírez O., and Polo P. collected the data. Valenzuela N., Pita M. and Fernández A. analyzed the saliva samples. Díaz D. calculated fluctuating asymmetry. Rodriguez-Sickert translated the manuscript and critically reviewed the first version, and provided a substantial improvement to it. All of the authors also contributed in successive phases to revising the manuscript to improve its technical and scientific quality.

Abstract

The decision to allocate time and energy to find multiple sexual partners or raise children is a fundamental reproductive trade-off. The strategic pluralism hypothesis argues that human reproductive strategies are optionally calibrated towards mating or raising children, according to the expression of features dependent on the individual's condition, such as a selective response to the reproductive trade-off. This study seeks to test predictions derived from this hypothesis in a sample of 243 young men (M ± SD = 22.21 ± 3.20) from Chile's 5th Region. Specifically, three predictions were considered that raise questions about the relationship between traits related to physical and psychological attractiveness (fluctuating facial asymmetry and self-perception of attractiveness) and competitive skills (baseline testosterone and self-perception of fighting ability) with short-term reproductive strategies. Our results indicate that psychological features related to the self-perception of physical attractiveness and competitive abilities are related to short-term reproductive strategies. It was also established that the effect of fluctuating facial asymmetry on short-term reproductive strategies is fully mediated by the self-perception of physical attractiveness. No evidence was found of any interaction between traits that denote physical attractiveness and those that denote competitive skills. These results support the existing evidence of the importance of facial fluctuating asymmetry as a highly-valued characteristic in terms of sexual selection. They also suggest that traits related to physical attractiveness, in comparison to competitive capabilities, play a relatively more important role in calibrating men's short-term reproductive strategies.

Key words: Strategic pluralism, attractiveness, competitive abilities, testosterone, men

Introduction

Reproductive strategies can be defined as an integrated set of adaptations that constitute solutions to different reproductive compromises or trade-offs that the individual faces (1,2). The strategic pluralism hypothesis seeks to explain inter- and intra-individual variation in human reproductive strategies based on the expression of traits dependent on the condition of the individual in interaction with the environment. This hypothesis emphasizes the costs and benefits for men and women with respect to the resources invested in seeking partners versus providing parental care (2,3). The trade-off for men between the search for a partner and parental care is particularly relevant given that men invest less than women in parental care while having a higher potential reproductive rate (4). This means that for men maximizing reproductive success is mainly constrained by the degree of access to multiple reproductive partners (4,5). In this sense, the ability to attract partners and to compete with individuals of the same sex are two factors that affect the resolution of this trade-off, given that they reduce the costs of electing a partner and intrasexual competition, respectively (6). Consequently, the integrated study of these two factors is key to understanding their influence on short-term reproductive strategies.

Physical attractiveness is directly related to the capacity of being chosen as a mate (6–8). Research in this field has identified a series of bodily features associated with attractiveness, fluctuating facial asymmetry being one of these (9,10). Fluctuating facial asymmetry has been proposed as an indicator of genetic quality that reflects the capacity of an individual to maintain a symmetric pattern of stable development (9). It has been observed men with relatively lower levels of fluctuating facial asymmetry are considered more attractive by women, are more economically successful, less faithful and less inclined to invest in their progeny (11–14). These results are consistent with evidence that men with lower levels of fluctuating facial asymmetry have more sexual partners and tend to be more direct in approaching the opposite sex in the context of

78 courtship, a characteristic that is related to short-term or unrestricted reproductive strategies
79 (2,8,10,15,16). Nevertheless, other investigations (17,18) have not been able to replicate the
80 association between the number of sexual partners and fluctuating facial asymmetry in men. These
81 contradictory findings indicate the need to generate new studies in the field including psychological
82 variables that can influence the relationship between fluctuating facial asymmetry and reproductive
83 success. Particularly relevant for our study is the relationship that has been observed between self-
84 perception of physical attractiveness and the prevalence of short-term reproductive strategies since
85 there is an association between self-perceived characteristics and received social signals, which
86 together affect behavior. That is, the assessment of one's attractiveness is associated with short-
87 term strategy because it reflects the preference of women for certain traits (6,19,20).

88 At the level of competitive abilities, intrasexual competition is another component that
89 influences access to partners of the opposite sex (6,21). It has been evidenced that testosterone is
90 related to the development of the traits and behaviors related to intrasexual competition, as the
91 display of direct physical aggression (22). T is an androgenizing hormone with two main types of
92 effects: organizational and activational. At the organizational level, it has an androgenizing effect
93 during the prenatal stage and at puberty. At the activational level, baseline T levels, as well as
94 changes in circulating T levels, have been associated with behavioral changes related to intrasexual
95 competition and reproductive efforts (23–25). Focusing on baseline T, there is evidence that
96 baseline T levels are positively related to dominance, aggression, and competitiveness. (23,26).
97 While lower baseline T levels have been associated with men's relational states and paternity
98 (27,28); that is, baseline T levels are lower in men involved in long-term relationships, and especially
99 in those that are fathers. However, these levels can be expected to remain high in men who,
100 although involved in a relationship, are highly interested in having extramarital relationships (30,
101 31,32). Puts et al. (2016) studied the relationship between T levels and three dimensions of

sociosexuality: sociosexual desire, sociosexual behavior, and sociosexual attitudes. Their results indicate that T levels are postively related to unrestricted sociosexual psychology (desires and attitudes), which results in a larger numer of reproductive partners (behavior). However, the number of reproductive partners can have a negative effect on T levels by providing a negative feedback mechanism that prevents maintaining high T levels once socio-sexual desires have been satisfied. This suggests that T plays an important role in the willingness of individuals to compete for reproductive partners, primarily through dominance mechanisms, which in turn implies searching for short-term strategies. This relationship is complex because there are negative regulation mechanisms. At the psychological level, testosterone increases competitive behavior and reduces cooperation in determined contexts (26). This suggests that self-perception of fighting ability is positively related to signs of dominance in competitive contexts and that T levels influence intrasexual competition and reproductive success (23,32,33).

Competitive abilities and physical attractiveness do not act independently. Lukaszewski et al. (2014) examined the effect of body strength as an indicator of both fighting ability and attractiveness, and the self-perception of physical attractiveness, as well as the assessment by third parties of physical attractiveness and sociosexual skills and behaviors. Their results show that self-perception of physical attractiveness mediates the positive effect between physical strength, unrestricted socio-sexual attitudes and the number of sexual partners. This indicates the need to explore the way in which indicators of physical attractiveness and fighting ability explain unrestricted human reproductive strategies, using a larger number of morphological, physiological and psychological indicators.

Considering all of the above, we can establish that attractiveness and competitive abilities are important elements of unrestricted reproductive strategies, as well as a possible combined effect of the two when unrestricted reproductive strategies are displayed. However, there have

been few studies that consider biological and psychological (morphological and physiological) variables in an integrated manner in order to understand how reproductive trade-offs are dealt with. The objective of this study is to investigate how the features of physical attractiveness and competitive abilities influence short-term male reproductive strategies. To do this, fluctuating facial asymmetry and the self-perception of physical attractiveness are considered as anthropometric and psychological features of physical attractiveness. Likewise, the levels of circulating baseline testosterone and self-perception of fighting ability are considered physiological and psychological features associated with competitive capacity. It can thus be expected that i) there is a positive relationship between physical attractiveness and short-term reproductive strategies, and a negative relationship between fluctuating facial asymmetry and the self-perception of attractiveness. The psychological variable (self-perception of attractiveness) is expected to mediate the effect of the physical variable (fluctuating facial asymmetry) on short-term strategies, ii) that there is a positive relationship between baseline T, self-perception of fighting ability and short-term reproductive strategies. Finally, when analyzed as a whole, iii) the individual's competitive abilities are expected to moderate the effect of attractiveness on short-term reproductive strategies. In this way, attractiveness has a positive effect on short-term reproductive strategies that is greater for individuals who are highly competitive.

Materials and methods

Participants: The initial sample was composed of 246 young men. However, three individuals were rejected because they failed to complete the questionnaires, so the sample was reduced to 243 men between 18 and 36 years of age ($M \pm DE = 22.21 \pm 3.20$). The participants were recruited using ads posted in universities in the 5th Region of Chile. In terms of sexual orientation, 97.5% stated they were heterosexual, 3.5% stated they were homosexual, and 53.8% stated they were in a couple at the time of participating in the investigation.

The research was approved by the ethics committee of the sponsoring university. The participants received an economic incentive of a payment of five thousand Chilean pesos (approximately seven US dollars) as an economic incentive for participating, plus up to 30,000 pesos (approximately 43 USD and almost twice of the daily minimum wage) conditional on their performance in the economic games that the study comprised.

Psychological measurements

Sociosexual orientation scale (SOI): We used a multidimensional version of the SOI developed by Jackson & Kirkpatrick (2007) that had been applied previously with Chilean subjects (see Polo, et al., 2019). The scale is divided into attitudinal and behavioral dimensions. There are two attitudinal factors that measure sociosexual orientation in the short-term (e.g. *"I can easily imagine being comfortable with and enjoying casual sex with different women"*, 10 items) and long-term (e.g. *"I am interested in maintaining a long-term romantic relationship with a special woman"*, 7 items). These dimensions are in the format of 7-point Likert scale responses in which 1 indicates "strongly disagree" and 7 indicates "strongly agree". The behavioral dimensions consisted of 5 items of open-ended responses that included questions about the number of sexual partners in the past (3 items) (e.g. *"Over your entire life, how many women have you had complete sexual relations with?*), a question about sexual fantasies *(How often do you fantasize about having sexual relations with women other than your current partner?)* and a question about the expected number of sexual partners in the future *(How many women do you think you will have sexual relations with in the next five years*). This study only considered the items referring to the attitudinal factor in short-term relationships. Polo et al. (2019) obtained a Cronbach α value of .95 for the aforementioned factor, while a Cronbach α of .70 was obtained in the present study, indicating that the instrument is sufficiently reliable.

Self-perceived fighting ability questionnaire (SPFAQ): We used a version of the SPFAQ developed by Muñoz-Reyes et al. (2012), which had been applied previously with Chilean subjects (see Muñoz-Reyes, Fernández, Flores-Prado, Guerra, & Turiégano, 2015). This is a short 4-question questionnaire that assesses the self-perception of fighting skills (1. How good a fighter am I? 2. How do others perceive my abilities as a fighter? 3. How much fear can I provoke in someone who is about to fight me? 4. What are my odds of winning a fight if I have to fight someone?). The responses are on a seven-point Likert scale in which 1 indicates "well below average" and 7 indicates "well above average." Muñoz-Reyes, Fernández, Flores-Prado, Guerra, & Turiégano (2015) obtained a Cronbach α score of .84 in the original study. In the present study, an α coefficient of .87 was obtained, indicating adequate reliability for the studied sample.

Self-perception of attractiveness: This consists of a single question to assess self-perception of physical attractiveness (How attractive do you think you are*?*). The response is on a 7-point Likert scale in which 1 indicates “not attractive at all” and 7 indicates “very attractive”.

Anthropometric measurements

Fluctuating facial asymmetry: This indicator of attractiveness is measured according to the protocol of Sanchez-Pages & Turiegano (2010). Frontal photographs were taken of the participants with a Nikon D-90 camera. Participants were asked not to wear any form of facial adornment and to maintain as neutral an expression as possible. Photos where the subject smiled or inclined his head were rejected. Fluctuating facial asymmetry was calculate based on 106 facial points or landmarks (LM), which were obtained with the program FACE ++ (see Kosinski, 2017 for a similar procedure; Zhou, Fan, Cao, Jiang, & Yin, 2013). This software identifies high-precision facial reference points, like facial contours, eyes, eyebrows, and nose. The use of this software was automated with a MatLab software algorithm connected to the interface of programming applications of FACE ++. Fluctuating facial asymmetry was determined with the software MorphoJ (Klingenberg, 2011; also

see http://www.flywings.org.uk/MorphoJ_page.htm) based on the Procrustes distances between each LM the corresponding mirror image LM. These distances were then broken down by Procrustes analysis into directional asymmetry and fluctuating asymmetry (39,40).

Baseline testosterone: Baseline testosterone was measured with a 1-ml sample of saliva of the participants, who were asked not to eat or drink anything other than water for at least one hour before the sample was taken. The samples were taken at approximately noon to avoid alterations in testosterone levels as the result of circadian hormonal variation. A passive saliva collection method (Salimetrics®) was used to collect samples. After being collected, the samples were centrifuged, frozen and stored at -20°C in cyrotubes (SalivaBio®) for 20 days. All the samples were analyzed with the Testosterone Enzyme Immunoassay Kit (Salimetrics®) in accordance with manufacturer's instructions. Due to a problem with storing the saliva samples (freezing rupture and consequent increase in temperature), 136 individuals were not included in the baseline testosterone analysis because the intra and interplate variation coefficients were very high. Thus, the sample for all the baseline testosterone analyses was 107 individuals. The coefficients of intraplate and interplate variation were respectively equal to and less than 15%.

Statistical analysis: A general linear model was applied in a first stage for the first hypothesis. Self-perception of attractiveness and fluctuating facial asymmetry were considered independent variables and short-term socio-sexual orientation was considered the dependent variable. The age and relational status of the subjects were also considered as control variables. The analysis of the residues showed that the variables are not distributed normally in the model. We transformed the variable of short-term sociosexual orientation to its quadratic form in order to tackle the issue of normality. To the extent that the results with and without transformed variables did not vary in terms of their statistical significance, we only report the results without the transformation. A mediation analysis was applied in the second stage, in which fluctuating facial asymmetry was

considered as an independent variable and short-term socio-sexual orientation as a dependent variable, and self-perception of attractiveness was considered a mediating variable. The age and relationship status of subjects were also considered.

For the second hypothesis, a general linear model was applied in which self-perception of fighting abilities and baseline testosterone levels were considered independent variables. As with hypothesis 1, the age and relational status of the subjects were included as control variables. Because of the reduced sample size with the introduction of the baseline T variable and because it did not have a statistically significant effect on the model, the variable was eliminated to restore the complete sample. Even though the residues in the latter model were normally distributed, an extreme outlier was identified that was confirmed with the statistical Tukey test, because of which the subject was eliminated. The value of the outlier was -37.10, which is lower than the limit considered by the Tukey test (-37,10 < -8.3543 – 1.5*19.058; -8.3543 being the first quartile and 19.058 the interquartile range). Finally, for the third hypothesis, a general linear model tested whether there was an interaction between fighting abilities and the self-perception of physical attractiveness, controlling again for age and the relational status of the subjects on short-term reproductive strategies. The normality of residues was verified for the second and third hypothesis. IBM SPSS 21.0 software was used for the general linear models and PROCESS software was used for the mediation analyses (41) . The level of significance was set at $\alpha = .05$.

Results

Table 1 shows the descriptive statistics for the morphological, physiological and psychological variables. A general linear model as shown in Table 2 was applied for the first hypothesis. The results indicate a positive effect of the self-perception of attractiveness (*B*= 2.42, *p*= .007) on unrestricted reproductive strategies (measured using the short-term sociosexual

orientation scale), as shown in Figure 1. However, FFA did not appear to have any effect on unrestricted reproductive strategies (*B*= 198.91, *p*= .291).

Table 1: Descriptive statistics (M±DE) for the entire sample for the variables, SPFAQ, SPA, short-term SOI, FFA.

Variable	N	M ± DE
SPFAQ	243	16.82 ± 4.88
SPA	243	4.68 ± .96
Short-term SOI	243	44.30 ± 13.47
FFA	243	.01 ± .00

Note: Self-perceived fighting ability questionnaire (SPFAQ), self-perception of attractiveness (SPA), Short-term sociosexual orientation Instrument (Short-term SOI). Fluctuating facial asymmetry (FFA)

Table 2: General linear model for short-term SOI, n=243 considering partner, age, SPA and FFA as variables

Parameter	B	Typical error	T	Sig.	η_p^2
Intersection	21.20	7.54	2.81	.005	.032
Partner= 1	-3.53	1.68	-2.09	.037	.018
Age	.47	.27	1.72	.087	.012
SPA	2.42	.89	2.72	.007	.030
FFA	198.91	187.84	1.05	.291	.005

Note: Partner=1 (with a partner n=130), self-perception of attractiveness (SPA), fluctuating facial asymmetry (FFA)

Figure 1. Dispersion diagram representing the relationship between self-perceived physical attractiveness and the short-term SOI score in function of individual relational status. The scores represent the observed values for individual without partners (empty circles) and with partners (filled circles). The lines represent the values estimated by the model in the range for individuals without partners (dashed line) and with partners (solid line). Age and fluctuating facial asymmetry were assessed in their mean values.

An analysis was then made with fluctuating facial asymmetry, self-perception of attractiveness, and short-term SOI. Figure 2 shows the observed results of measurement by the model. There was an indirect effect of FFA on short-term reproductive strategies (*B*= -69.18, *BootSE*= 44.65), with a confidence interval of 95%, calculated using a bootstrapping procedure, with a lower limit of -173.47 and an upper limit of -2.75. There is no significant direct effect of FFA on short-term SOI (*B*= 198.92, *p*= .291). The effect of FFA is fully captured by self-perception of attractiveness.

Figure 2. Unstandardized regression coefficients between FFA and short-term SOI mediated self-perception of attractiveness controlling for age and relational status, n=243. The standard errors are shown in parentheses.

Note: Fluctuating facial asymmetry (FFA), self-perception of attractiveness (SPA), short-term socio-sexual orientation instrument (short-term SOI) *p<.05; **p< .01; ***p< .001

Table 3 shows the results for the second prediction, an effect of competitive abilities was found (β= .62, p= .016), but no effect of baseline T was found as an explanatory variable of short-term reproductive strategies (β= .01, p= .510). These observations were made for the reduced sample (n=107).

Table 3: General linear model 1 for short-term SOI, n=107 considering partner, age, SPFAQ, and baseline T as variables

Parameter	B	Typical error	T	Sig.	η_p^2
Intersection	25.95	11.97	2.16	.033	.044
PARTNER=1	-5.59	2.79	-2.00	.048	.038
AGE	.33	.42	.79	.429	.006
SPFAQ	.62	.27	2.44	.016	.055
Baseline T	.012	.01	.66	.51	.004

Note: Partner=1 (with a partner), Age, Self-perceived fighting ability questionnaire (SPFAQ) and baseline testosterone (baseline T).

Given that no effect of baseline T was established, a second model was tested for the complete sample (n=242) excluding this variable. In this case, a significant effect of self-perceived competitive abilities was found (*SPFAQ*; *B*= .38, *p*= .030, see Table 4 and Figure 3)

Table 4: General linear model 2 for short-term SOI, n= 242, considering partner, age, and SPFAQ as variables, and eliminating the outlier of the residues from the sample

Parameter	B	Typical error	T	Sig.	η_p^2
Intersection	27.77	6.38	4.35	.000	.073
PARTNER=1	-4.44	1.68	-2.63	,009	.028
AGE	.58	.26	2.21	.028	.020
SPFAQ	.38	.17	2.18	.030	.020

Note: Partner=1 (with a partner), Self-perceived fighting ability questionnaire (SPFAQ).

Figure 3. Dispersion diagram depicting the relationship between the self-perception of fighting capacity and the short-term SOI score in function of the relational status of the individuals. The score represents the observed values for individuals without a partner (empty circles) and with a partner (filled circles). The lines represent the values estimated by the model in the range observed for individuals without partners (dashed line) and with partners (solid line). The age was estimated at the mean value.

The effects of the variables in the model were tested for the third prediction, and a positive effect was found for self-perceived attractiveness (B = 1.89, p = .041) on short-term strategies, as shown in Table 5. We tested to determine if there is an interaction between attractiveness traits (based on self-perceived attractiveness) and fighting abilities (based on the SPFAQ questionnaire). As shown in Table 6, no effect was observed for the interaction between the two variables on short-term strategies.

Table 5: General linear model 2 for short-term SOI, n= 242, considering partners, age, SPFAQ and SPAQ as variables

Parameter	B	Typical error	T	Sig.	η_p^2
Intersection	23.19	6.97	3.32	.001	.045
PARTNER=1	-4.37	1.68	-2.59	.010	.028
AGE	.47	.28	1.73	.084	.013
SPFAQ	.25	.18	1.40	.160	.008
SPA	1.89	.92	2.05	.041	.018

Note: Partner=1 (with a partner). Self-perceived fighting ability questionnaire (SPFAQ). Self-perception of attractiveness (SPA).

Table 6: General linear mode 3 for short-term SOI, n= 242, considering partners, age, SPFAQ and SPA, and the interaction between SPA and SPFAQ as variables

Parameter	B	Typical error	t	Sig.	η_p^2
Intersection	46.04	15.18	3.03	.003	.038
Partner=1	-4.53	1.68	-2.69	.008	.030
AGE	.48	.27	1.76	.078	.013
SPFAQ	-1.16	.85	-1.35	.177	.008
SPA	-2.95	3.00	-.98	.327	.004
SPA * SPFAQ	.29	.17	1.69	.092	.012

Note: Partner=1 (with a partner). Self-perceived fighting ability questionnaire (SPFAQ). Self-perception of attractiveness (SPA).

Discussion

The strategic pluralism hypothesis explains the conditionality of human reproductive strategies and the resolution of the trade-off between investment in multiple partners and investment in parental care (42). This hypothesis considers that there are biological, psychological and anthropometric factors that calibrate reproductive behavior according to the context in which the individual faces the aforementioned trade-off. This study proposes three partially supported hypotheses. Specifically, it emphasizes the role of competitive abilities and physical attractiveness in men on the unfolding of unrestricted reproductive strategies (short-term strategies at the scale

of sociosexual orientation). The main result indicates that the traits of attractiveness have a greater effect on unrestricted reproductive strategies than does fighting abilities.

The first hypothesis sought to determine if there is a positive relationship between physical attractiveness, as measured by fluctuating facial asymmetry and the self-perception of attractiveness, and unrestricted reproductive strategies. Our results suggest that fluctuating facial asymmetry has no effect, while self-perceived attractiveness does have an effect. Simpson et al., (1999) found similar results for fluctuating facial asymmetry, and were unable to establish a relationship between this variable and unrestricted sociosexuality. In contrast to Simpson et al. (1999), our investigation involved conducting mediation analysis, which allowed us to establish for the first time that the relationship between fluctuating facial asymmetry and unrestricted reproductive strategies can be fully mediated by the self-perception of attractiveness. This result is consistent with those of other investigations that have found the effects of morphological features on the psychology of unrestricted male sociosexual behavior (for example, facial masculinization in Kruger, 2006; corporal strength in Lukaszewski et al., (2014); and skeletal muscle and strength in Kordsmeyer, Hunt, Puts, Ostner, & Penke, 2018). Therefore, more physically attractive men in this study, that is, men with lower fluctuating facial asymmetry, displayed unrestricted reproductive strategies, which in turn was mediated by the self-perception of attractiveness. This supports the theoretical assumptions of the strategic pluralism theory (2) by maintaining that attractive men opt for maximizing short-term reproductive partners over increasing parental investment. This makes senses, especially if we consider that fluctuating facial asymmetry has been associated with the implementation of short-term reproductive strategies (16), with the number of sexual partners over one's lifetime (45,46), and with the perception of attractiveness (10). All of the above makes evident the role of physical attractiveness, and in particular of fluctuating facial asymmetry, in reproductive success. it has hypothesized that this importance is due to its evolutionary value, representing a

proxy for good genetic quality (2,6), which could be a signal to females for a male's inclination towards short-term relationships.

For the second hypothesis, we expected to find an effect of the markers of competitive abilities, measured using the self-perception of competitive abilities (SPFAQ) and baseline testosterone, on short-term reproductive strategies. An effect on unrestricted strategies was found for self-perception of fighting ability, but not for baseline T. Other studies have established a relationship between fighting and mate value (35), which is defined as "the complete set of characteristics that an individual has in a given moment and in a particular context that affects his capacity to successfully find, attract and keep a partner" (47). According to Muñoz-Reyes et al., (2015) , fighting ability is associated with the mate value of a partner, which implies a positive relationship between this variable and men's assessments of their chances of finding partners, and therefore of employing intrasexual competition strategies, which implies a high degree of self-confidence in the search for partners. It has been established that the self-perception of fighting ability is also associated with aggressive behavior (22). These findings, together with the results of our investigation, indicate that it is plausible to support that fighting ability is a conflict resolution mechanism in situations of intrasexual competition, which is consistent with studies that have found a positive association between traits associated with fighting abilities and reproductive success ((20,35,48). No effect was found for baseline testosterone on short-term reproductive studies, as had been expected. Studies have associated testosterone with the search for social status (49), self-confidence in competitive situation (33) and the adoption of dominant roles in economic environments (26). Consequently, testosterone can be considered a social hormone associated with status-seeking and not so much with aggression in itself. Status in turn could be related to different reproductive strategies according to the way it is acquired. The relationship between testosterone and reproductive strategies has been explored in other studies and evidence has been found that

355 favors the role of testosterone as a promoter of short-term strategies. For example, Edelstein,
356 Chopik, & Kean, (2011) found an interaction between unrestricted sociosexuality and the relational
357 state of men, and established that men in relationships with partners, but that have interest in
358 extramarital relationships, have similar testosterone levels as those of single men, producing a
359 positive attitude about unrestricted strategies. Puts et al. (2016) established that there is a negative
360 relationship between of sexual partners and baseline T, and a positive relationship between high
361 levels of baseline T and unrestricted sociosexual psychology (desire and attitudes). Although this
362 investigation employed a reduced version of the sociosexual orientation questionnaire (50), a
363 relationship was found between baseline T levels and an orientation toward short-term strategies.
364 The reduced sample in the model that assesses the effect of baseline T on reproductive strategies
365 could explain the null result with respect to this variable.

366 On the basis of the third hypothesis, a relationship was expected between attractiveness
367 (measured by the self-perception of attractiveness) and competitive abilities (measured by the self-
368 perception of fighting abilities) on unrestricted strategies. A significant effect of self-perception of
369 attractiveness was found, although not of fighting skills, which supports the results of previous
370 studies (e.g., Muñoz-Reyes et al., 2015) that fighting skills are an important feature at the time of
371 engaging in intrasexual competition, but there are variables linked to attractiveness (such as self-
372 perception) that have a greater effect in terms of intersexual selection for the case of unrestricted
373 strategies (6). In this sense, competitive abilities can be understood as a set of features that make
374 up attractiveness and that together exercise an effect on men's unrestricted reproductive
375 strategies.

376 Among the limitations of this research is the inclusion of only one anthropometric
377 measurement (fluctuating facial asymmetry), which, although a robust measurement to study
378 physical attractiveness, could be complemented with others that are also considered attractive

features. Another limitation was the loss of data due to the storage of samples and handling of the T kit, despite following protocols tested in other investigations. Other anthropometric variables associated with unrestricted strategies should be included in future research, such as facial masculinization (30), height (e.g. Polo, Fernandez, Muñoz-Reyes, Dufey, & Buunk, 2018) and body mass (e.g. Polo et al., 2019).

In conclusion, the present study contributes evidence to the hypothesis of strategic pluralism with respect to the importance of features of attractiveness to explain unrestricted reproductive strategies among men and where competitive skills are configured as a relevant mechanism in acting out intrasexual competition strategies. These findings support the hypothesis of strategic pluralism, which explains the reproductive trade-off that men have between maximizing the number of sexual partners and investing in parental care, considering the importance of the interaction among anthropometric features on the self-perception (that is, psychological features) of subjects when the reproductive trade-off is solved.

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Figure1

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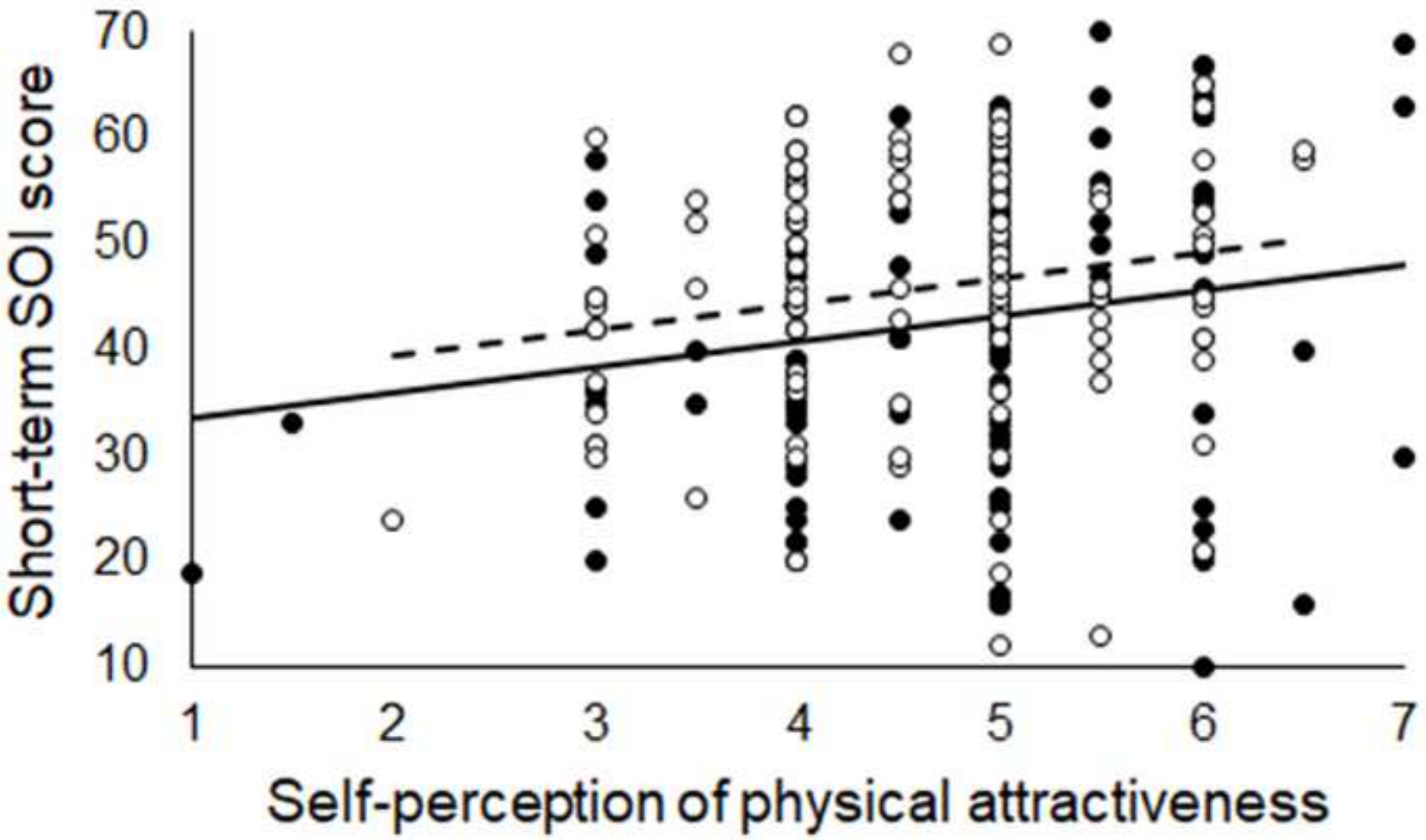

Figure2

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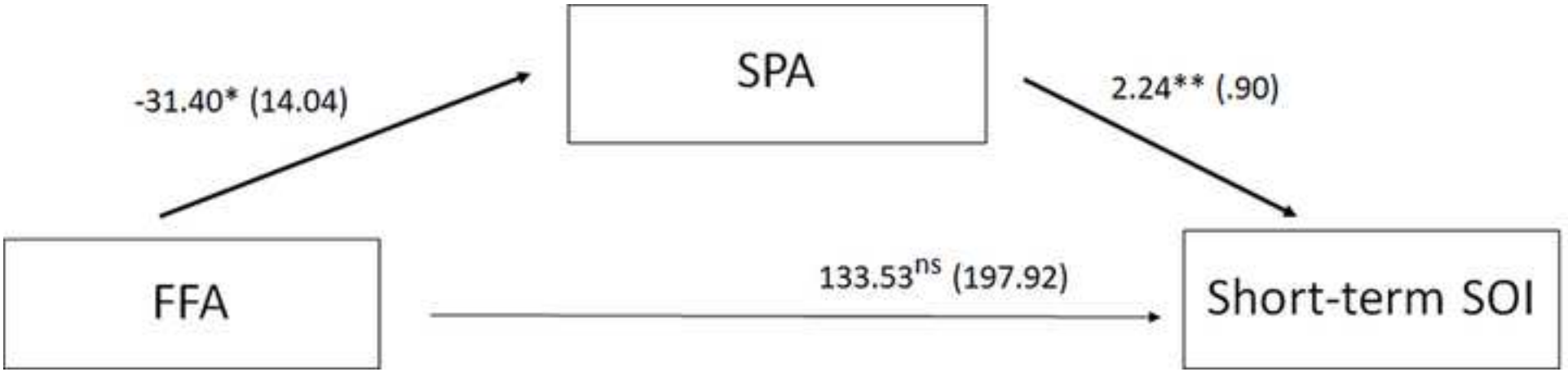

Figure3

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